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Review Report of the RBEP State Grant Projects (2000)

Abstract

The Regional Biomass Energy Program (RBEP) is a federally funded program with the specific goal to increase the production and use of bioenergy resources. The RBEP serves as a critical link in furthering bioenergy development. The program carries out activities related to technology transfer, infrastructure development, industry support, stakeholder relationships, technology development and demonstration, and matching available bioenergy resources to conversion technologies. Its major focus is the transfer of current, reliable economic and technical information to potential bioenergy users. With its five regional programs and its state agency contacts, RBEP offers a well-connected national network of experts to serve regional and local needs. Over the next five years, the RBEP plans to build on its successes in communicating information to key constituency groups, leveraging private and public resources, and facilitating the demonstration of innovative technologies and processes for efficiently utilizing biomass resources for energy applications. This *Review Report of the Regional Biomass Energy Program State Projects* provides a brief narrative of some of the state initiatives being conducted within the five regional programs. Each RBEP seeks active cooperation and cost sharing with states, private industry, universities, and other federal agencies for its state-funded initiatives. Beyond the potential economic development benefits, participating states gain the opportunity to strengthen and integrate the work of energy, forestry, air quality, and other relevant offices through the RBEP's promotion of bioenergy use programs.

Introduction

The RBEP is a U.S. Department of Energy (DOE) sponsored effort located in five regions of the United States (U.S.). The first regional program was launched in 1979 for several states in the Northwestern U.S. The Congress formally established the RBEP in 1983, and three more regions-the Great Lakes, the Northeast, and the Southeast-were added at that time. A fifth region including the remaining 13 Western states (continental U.S.), was created in 1987.

The Great Lakes Regional Biomass Energy Program (GLRBEP), where seven states collaborate, is managed by the Council of Great Lakes Governors. A similar arrangement exists at the Coalition of Northeastern Governors (CONEG) Policy Research Center, which manages the 11-state Northeast Regional Biomass Program (NRBP). At the Southeastern Regional Biomass Energy Program (SERBEP), the Southern States Energy Board manages the program where 13 states, the District of Columbia, Puerto Rico, and the Virgin Islands participate. The 13-state Western Region Biomass Energy Program (WRBEP) is managed by the Nebraska Energy Office. Each of these four regions reports to a DOE Regional Office for guidance and administrative management. The Pacific Northwest & Alaska Regional Bioenergy Program (PNW&ABP) is managed by the DOE Seattle Regional Office and works with five states. A sixth state, Hawaii, will be joining that region in 2001.

The specific RBEP objective is to increase the production and use of bioenergy resources. As defined by its enabling legislation, the aims of the RBEP are to:

- Improve industry and government planning efforts, particularly those assessing current and future biomass resource availability, its use, and applied research needs
- Encourage economic development through public and private investment in bioenergy technologies, and
- Support applied research and demonstrate bioenergy technologies on a cost-shared basis, reduce or eliminate market barriers, understand economic and environmental costs and risks, and accelerate the market acceptance of bioenergy technologies.

The RBEP carries out activities related to technology transfer, infrastructure development, industry support, stakeholder relationships, technology development and demonstration, and matching available bioenergy resources to conversion technologies. With an emphasis on technologies best suited to near-term applications, its major focus is the transfer of current, reliable economic and technical information to potential biomass users. The result is a rich variety of strategies and applications for regional biomass resources to meet regional energy needs. Each RBEP generally conducts its activities in two interactive arenas.

- Cooperative initiatives with individual state governments match local opportunities with resources and address area-specific problems to find local solutions. Beyond the potential economic development benefits, participating states have the opportunity to strengthen and integrate the work of energy, forestry, air quality, and other relevant offices in promoting bioenergy use. For some regions, the state grant component is a primary method for conducting development and demonstration projects.

- Region-wide technical projects address issues common to the majority of member states. For technical projects, each region seeks active cooperation and cost sharing between the participating states, private industry, trade associations, private farm owners, universities, and other federal agencies. Since its beginning, the RBEP has been a highly leveraged program. For every federal dollar invested, RBEP partners cost-share at least two dollars.

The RBEP is managed and funded by the Office of Fuels Development (OFD) in collaboration with the Office of Biopower and Hydropower Technologies (OBHT). The RBEP works closely with each group in leveraging its resources to facilitate the development of bioenergy technologies and biomass resources. Both the OFD and the OBHT formulate, execute, and coordinate a balanced and customer-focused national program of applied technology research, development, and demonstrations of technologies to produce transportation fuels and power from biomass resources.

The RBEP can assist the OFD and OBHT in identifying, developing, and implementing special projects that move their technologies from the R&D stage into the marketplace. The RBEPs are in a unique position to facilitate this effort by educating decision makers at the state and local levels and helping to promote the use of these technologies by the general public.

This *Review Report of the Regional Biomass Energy Program State Projects* provides a brief narrative of some of the state initiatives being conducted within the five regional programs. Each RBEP seeks active cooperation and cost sharing with states, private industry, universities, and other federal agencies for its state-funded initiatives. Beyond the potential economic development benefits, participating states gain the opportunity to strengthen and integrate the work of energy, forestry, air quality, and other relevant offices through the RBEP's promotion of bioenergy use programs.

As one example of the value of the state projects to help DOE meet its strategic objectives, the RBEP has initiated an Ethanol Workshop Series (EWS) that was sponsored by the OFD. The ultimate goal of the EWS and related follow-up activities is to help pave the way for producing ethanol from cellulosic feedstocks at a state level. This process starts with educating key government officials and the general public about ethanol fuels and their benefits. The next step is to create market demand for ethanol fuels, followed by in-state production of ethanol, also by production of ethanol from cellulose-based feedstocks.

While the broad based goal of the EWS is to use energing technologies to develop a cellulose ethanol plant in every participating state, the program works closely with the grain ethanol industry, and also encourages the development of new markets for ethanol. The 1999 Workshops were held in Alabama, Alaska, Maine, Michigan, Mississippi, South Dakota, and Wisconsin. The 2000 workshop states are Colorado, Indiana, New York, Ohio, Oregon, and Washington, Pennsylvania, South Carolina, and Texas. Up-to-date information can be found at http://www.bbiethanol.com. Bryan and Bryan, Inc. (BBI), who provided logistical support for the EWS, maintains the web site. As one of their key duties, BBI established a state steering committee for each workshop and worked with these committees to insure that the workshops reflected community needs and incorporated local speakers into the agenda.

As reinforced by the EWS, the importance of positive, supportive attitudes toward bioenergy use by government officials and other public policy makers is a vital "lesson learned" from the RBEP states in developing the bioenergy industry. Developing positive attitudes for bioenergy is based on credible information, public education, and sound technology demonstration. Information regarding the economic and environmental advantages of bioenergy use, resource data and capacity assessments, and the potential applications for new products and technologies made from biomass still needs to be shared with a variety of audiences.

In addition to the state projects that follow, the five RBEPs have over 75 region-wide technical projects under way.

Great Lakes

Illinois

The Illinois Biomass Energy Program (IBEP) has been active in a wide variety of bioenergy projects. Because the state is the second leading annual producer of corn and the leading producer of ethanol in the country, much of Illinois' focus has been biomass-derived ethanol. As a result, the state annually leads the nation in the use of ethanol as a transportation fuel. More than 95% of all the gasoline sold annually in Chicago, and over 60% of all the gasoline sold in the state, contains 10%

ethanol (E-10). One example of the state's efforts to expand ethanol use is the Illinois E-85 (85% ethanol) Infrastructure Development Program. Because Chicago has been designated as an ozone non-attainment area by the U.S. Environmental Protection Agency (EPA), fleets located there and in the surrounding counties are required to purchase alternative fuel vehicles. For example, the U.S. Postal Service (USPS) recently purchased 21,000 E-85 FFV delivery trucks, many of which have been assigned to the Chicago area. To help meet the refueling needs of this growing number of E-85 vehicles, 10 new public E-85 refueling facilities have opened in the Chicago area. It is expected that this program will be expanded to all parts of the state in the future. A second example of efforts designed to increase ethanol use is the "E-diesel" program, which is testing and demonstrating the use of ethanol-blended diesel fuel in unmodified heavy-duty diesel engines. The results obtained to date have been very encouraging. E-diesel combines up to 15% anhydrous ethanol with #2 diesel fuel, and uses special blending agents to keep the two fuels from separating under adverse conditions. Current laboratory studies indicate that E-diesel blends can significantly reduce harmful exhaust emissions with minimal fuel economy reductions and fuel cost increases. So far, this new fuel is being tested in two over-the-road trucks, 15 urban transit buses, a John Deere farm tractor and combine, and in a Ford F-250 pickup truck. This program holds tremendous potential for expanding the use of ethanol throughout the country. If E-diesel achieves the same market penetration that E-10 ethanol blended gasoline currently enjoys, the demand for biomass-derived ethanol could increase by nearly 500 million gallons per year.

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Indiana

Through the Energy Policy Division, the Biomass Energy Grant Program (BEGP) encourages Indiana industries to develop and use bioenergy technologies. In 1999, three projects were selected following a Request for Proposal process. The first project will demonstrate, on a pilot-scale, the enzymatic conversion of a cellulosic feedstock (straw) to ethanol using proprietary and patented technology. The technology includes (1) a non-acid proprietary steep delignification process to pretreat the feedstock, (2) the enzymatic simultaneous saccharificiation and fermentation (SSF) of cellulose and hemicellulose in a continuous stirred reactor separator (CSRS), (3) fermentation of xylose with simultaneous separation of ethanol from the fermentation broth in the CSRS, and (4) recycling the enzymes/fermentation broth from the CSRS. Two non-genetically altered yeast cultures will be used in the process. Other aspects of the process involve on-site generation of crude cellulase enzymes. The second project involves beginning work on an ethanol production plant in northwest Indiana. The project will include the design, fabrication, and testing of an 8-10 million Btu/hr gasifier. The unit will gasify a mixture of dried distillers grain (DDG) and seed corn, yielding a low Btu systhesis gas (syngas) that will be used in a boiler to generate steam for the proposed ethanol plant. Boiler exhaust will be used by the plant's DDG dryer. The third project will design and construct a prototype syngas storage system to be installed on a 40-kW biomass gasifier/electric generation demonstration project. The system will thus provide a decoupling between gasification and electricity generation. Syngas yielded from the gasifier will be cooled, cleaned, and transferred to a storage system that will then be used to fuel a piston-engine electric generator. This proposed system will allow the gasifier to operate at constant load over time period and be independent of the electricity load.

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Iowa

Iowa's Biomass Energy Program (IBEP) strives to make the state a world leader in the production and use of electricity, as well as gaseous and liquid fuels derived from biomass materials. One example of bioenergy production is the Chariton Valley Biomass Power Project, an initiative designed to establish switchgrass as an energy crop in southeast Iowa. Spearheading the initiative is the Chariton Valley Resource Conservation and Development (RC&D) district. The group is coordinating a 4,000-acre demonstration project to assist in the development of energy crops as a post-Conservation Reserve Program (CRP) alternative. The IBEP aids the switchgrass initiative by funding related research and demonstration projects, as well as conducting meetings to keep stakeholders informed and to provide an opportunity for collaboration and strategic planning. The near-term goal for the use of switchgrass is to co-fire it with coal at a local power plant. The goal is to replace 5% of the coal with switchgrass, the equivalent of 35-mW of generation capacity. A second IBEP program is the Methane Energy Recovery Program, which has the objective of evaluating and demonstrating animal manure anaerobic digestion (AD) technologies. The captured methane may be combusted in a boiler system, such as at the Crawford Farm in Nevada, or as an electric generation fuel such as at Swine USA. IBEP staff also works with an advisory committee of representatives from government agencies, agricultural organizations, utilities, environmental groups, and universities to further the development of AD technologies. Additionally, the IBEP supports efforts to increase the production and consumption of ethanol-blended fuel. Recently, the market share for ethanol-blended fuel in Iowa reached 49%, a historic high. IBEP staff also worked with a cooperative association that installed an eight million gallon per year ethanol plant that began producing fuel in 2000, as well as assisting a number of groups in studying the economic opportunities of ethanol production. At least one additional group is expected to construct a new cooperative ethanol plant.

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Michigan

The goal of the Michigan Biomass Energy Program (MBEP) is to encourage increased production and use of bioenergy through program policies, information dissemination, and state-funded projects. This year, the MBEP will provide approximately $150,000 in funding for seven state projects that have a total project cost of about $650,000. These projects include research on producing ethanol from sugar beet pulp, developing hydrogen technology to eliminate cold-start problems and improve emissions in E-85 vehicles, exhibiting an airplane converted to operate on ethanol at air shows and other fly-in events across the state, and vehicle testing for a 100% vegetable-based, bio-degradable motor oil. Three additional grants will be announced by the end of September, 2000. In cooperation with the OFD, the MBEP also hosted a second Michigan Ethanol Workshop in August. The workshop surpassed last year's attendance with 80 participants. Special workshop announcements included: a ban on MTBE use in Michigan by June, 2003; legislation enabling Agricultural Processing Zones to be established anywhere in the state and provided tax-free status for 15 years; a 40 million gallon/year corn-to-ethanol plant to begin construction soon and two additional plants are under discussion; and two new E-85 refueling sites, bringing the total in Michigan to six. As a result of the workshop, a group of public and private sector members is being formed to develop state promotional strategies for increased ethanol use.

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Minnesota

Minneapolis-St. Paul was selected by the DOE as one of three nationwide sites for a pilot program to develop markets for E-85. As a result, the Minnesota Biomass Program (MBP) joined in a consortium with other government agencies, non-profit organizations, agriculture commodity groups, and the Ford Motor Company to increase the number of E-85 fueling sites in Minnesota from 11 to 50. Minnesota now has 15 ethanol plants operating including the first urban ethanol plant in St. Paul. Seven of the plants are expanding to more than double their production capacity. In addition to producing ethanol, several plants have expanded into yeast production carbon dioxide (CO2) recovery, and a de-icer product. The MBP is partnering with Communities for Responsible Energy and Environment and Minnesota State University-Mankato to convert a hybrid electric vehicle to run on E-85 fuel, and to produce a combined demonstration of the hybrid electrics and E-85 technologies within the Minnesota environment. With the increased need for alternative forms of electricity, the MBP, in cooperation with Minnesota Rural Partners (MRP), the Minnesota Department of Natural Resources, and the City of St. Peter conducted a joint planning and educational outreach effort to increase the public knowledge about the production and use of biomass fuels. Outreach materials and presentations were made at meetings, which were followed up by personal visits with interested individuals and organizations. The largest Minnesota utility is required by the state legislature to generate a set percentage of all of its electricity production from alternative fuel sources, including biomass. A brochure on wood waste combustion for bioenergy is also being developed. All the information is available on the MRP web site.

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Ohio

The Ohio Biomass Energy Program (OBEP) has been active on a number of fronts to promote bioenergy use in the state. In May, 2000, the OBEP was the primary host for an OFD-sponsored workshop that explored the potential benefits of ethanol production plants for state economic development, agriculture, and the environment. Subsequent activities include an ongoing feasibility study for ethanol production in the state, and installation of the first two commercial E-85 fuel pumps. The program is working with a local Clean Fuels Coalition group, and is assisting in the development of a cable television piece that will highlight biofuels. The OBEP has also participated in the joint Great Lakes/Northeast States working group on the production and use of ethanol in the Northeast. Additionally, in a pilot project, the state transportation department is experimenting with the largest fleet use of biodiesel. In July 2000, the OBEP presented a paper, *The Prospect of Energy Crops in Ohio's Competitive Power Market*, at the GlobeEx 2000 conference hosted by the International Energy Foundation. A different version of this paper will also be presented at the Bioenergy 2000 conference in Buffalo. The OBEP is actively participating in various activities related to implementing the state's electric restructuring legislation, including interconnection tariffs for customers with self-generation or net metering, and in creating public awareness for green power options. The OBEP Program also participates in the annual Ohio Farm Science Review Fair. The scope and size of the fair make it a good venue for educational outreach, and for raising public awareness of the benefits of biomass and renewable energy use. In 1999, Fair attendance was more than 140,000 visitors. The Midwest Energy Research Center prepared the report, *Turning Manure Into Gold: Converting Agricultural Waste to Energy*, with OBEP support. This report provides practical reference information to the farming community on available technologies and resources for farm animal manure energy projects. The OBEP maintains a web site with a wealth of program and state biomass resource information. The program also publishes a periodic newsletter to complement its web site. The newsletter contains information of interest to the bioenergy community, including state and federal funding opportunities, workshop and seminar announcements, and availability of publications.

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Wisconsin

The Renewable Energy Assistance Program (REAP) has been a major vehicle for promoting and expanding the use of bioenergy in Wisconsin. In both the technical assistance and the construction portions of the program, REAP leverages petroleum violation escrow funds with matches from the grantee and their clients. REAP construction grants cover 10%-20% of the project's costs, based on the amount of non-renewable fuel being displaced. For example, three schools in northern Wisconsin have installed wood-fired boilers for space heating. In addition to REAP, Wisconsin is preparing to launch a second phase of of its 23-county public benefits pilot for all renewable energy resources. The first phase of the public benefits pilot yielded a number of interesting projects, as well as marketing and educational outreach materials. The state continues to receive and respond to a strong public interest regarding the use of waste wood produced by the forest and paper products industries. One project involved industrial paper pellet manufacturing, which also developed a marketing plan. A cooperative pilot project with the EPA will focus on wood-stove changeouts, replacing older wood stoves with EPA-certified stoves. A new biogas project at a 2500-cow dairy operation is in its second design stage. Another dairy is conducting a digester feasibility study. Wisconsin will also be participating in the RBEP's Ethanol Workhop Series this September. Many plans are in formulation for constructing new ethanol plants, including a 40 million gallon/year facility.

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Northeast

Connecticut

A farm cogeneration and manure management seminar was sponsored by the NRBP and the state Department of Agriculture in 1998. The one-day seminar focused on dairy manure digestion and farm cogeneration and provided insight on how to implement a successful project. Featured presentations came from USDA's Natural Resource Conservation Service, equipment manufactures, and digester consultants. Following the seminar, participants were invited to visit a working digester. The NRBP was also an exhibitor at CONNECT Day 1999 in New Britain. CONNECT is the Connecticut Energy Council for Teachers. CONNECT hosts an annual energy conference for its members with workshops and exhibits. The conference attracted 150 teachers from across the state. The NRBP, working with NREL, was able to set up a booth on biomass-to-ethanol technology. NREL provided a biofuels display and several publications. The NRBP staffed the booth and was able to provide teachers with information on the potential for biofuels in the Northeast.

Delaware

In 1999, more than 50 volunteers, staff from the state Department of Agriculture, and research scientists from the State University of New York College of Environmental Science and Forestry established a new willow demonstration site at the Blackbird State Forest. The 2.5-acre site contains more than 15,000 cuttings representing 14 different willow species. The site trial is being funded by a grant from the U.S. Forest Service and is managed by the NRBP through the state's biomass program. Later in 1999, the state's second biofuels test plantation, the first one dedicated to both willow and poplar, was established. More than 18,000 willow cuttings were planted on three acres. The NRBP has been instrumental in moving the willow technology throughout the Northeast. These site trials will provide important data on productivity in differing climates and soil conditions. The site trials also help to introduce the concept of energy crops to farmers. The NRBP is the lead for a

cooperative project to evaluate the technical and economic potential for the conversion of poultry litter to energy and other value added products. The NRBP is working with SERBEP, the Environmental Research Center at TVA, the Oak Ridge National Laboratory (ORNL), and the States of Maryland and Delaware on the project. Animal waste management is a major concern due to its impact on farm economics and water quality. The production of energy and other value added products from poultry litter will help to lower the cost of compliance for farmers and help improve water quality. Governor Carper of Delaware said that he planned to meet with electric utility companies and other state governors about using poultry litter as boiler fuel. The NRBP and SERBEP's work is considered very important in influencing and promoting the concept of energy from poultry litter. The Governor also talked of spending millions on biomass filter strips, a concept supported by the NRBP, SERBEP, and ORNL as a part of its Delmarva study. The NRBP held two briefings for Delaware officials during its work in evaluating the technical and economic potential for energy production from poultry litter on the Delmarva.

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Maine

The Maine Biomass Program (MBP) works with stakeholders on actions supporting the use of biomass as a cost-effective energy alternative. Program activities generally fall within the biopower and biofuels categories. In the biopower area, the MBP has been active on issues affecting existing bioenergy generators and the prospects for new wood-fired distributed generators. The MBP staffed the legislature's Commission on Sawmill Biomass, a group formed to consider biomass waste disposal issues associated with potential changes in the operation of bioenergy generation facilities. The Commission designed a tax credit that is now available, which will help biomass waste producers cover transportation costs in the event that finding different waste disposal options becomes necessary. The MBP has also worked with stakeholders to consider whether Maine's resource portfolio requirements are an efficient method to support Maine's indigenous renewable generators. The Program members are also considering how state and regional energy policies affect the prospects for distributed generation. In the biofuels area, the MBP has worked with stakeholders and the Legislature's Agricultural Products Utilization Commission to consider the technical, economic, and environmental feasibility of the biofuels industry in Maine. Other biofuels activities include active participation in NRBP projects related to ethanol, and dissemination of project findings to stakeholders in Maine.

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Maryland

The Maryland Energy Administration (MEA), in partnership with the Eastern Shore RC&D, established a test plot of hybrid Willow and Poplar in conjunction with the Salix Consortium. The Consortium, which is managed through the State University of New York, has established plots in several other states outside of New York. The Maryland site is similar in size to a site established in Delaware approximately three years ago and is located at the Wye Island Research and Education Center. Approximately 5,100 live stakes planted by volunteers included 16 different willow varieties. Four replications (318 plants per replication) of each varietal were planted. Once these plants become mature they will be harvested and the wood will be used to test several combustion options involving the co-firing of wood with other forms of biomass. The MEA is currently exploring the possibility of establishing a simple "off the shelf" small-scale combustion project at the Wye Island facility. The combustion system is commercially available in Europe. The combustion system will be used to obtain the data necessary to determine proper fuel characteristics, environmental constraints,

and to estimate energy output under variable fuel mixes. This first stage project will be limited to providing heat to a building. A microturbine and a gasification system would eventually be purchased to generate electricity from various forms of biomass if the first stage effort is successful. The MEA is also in the process of administering a project that will result in developing a fluidized bed system for combusting poultry manure. The project was accepted for funding by the Governor's Animal Waste Technology Committee, which is now sharing the funding effort with the MEA. Once the fluidized bed system is completely fabricated, it will co-fire a variety of biomass feedstocks with the poultry manure. The MEA recently attended the opening of the first E-85 refueling station in the state, which was developed in partnership with the Maryland Corn Growers Association. The project, partially funded by a grant provided by the DOE, will eventually result in the construction of four E-85 refueling stations. Since many state vehicles currently have the ability to run on E-85, these stations will provide the state with the opportunity to make substantial reductions in mobile source pollution.

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Massachusetts

The Massachusetts Division of Energy Resources (DOER) administers the Massachusetts Biomass Energy Development program (MBEDP) through a staff position. All biomass-related tasks are carried out in collaboration with ad hoc biomass working groups, which include the Massachusetts Departments of Environmental Protection (DEP) and Forests and Parks (DFP). Programs include: (1) Plans to construct wood-chip fueled gasification systems at the Wetmore Forest and Wood Products Institute and the Belchertown school district; (2) the Landfill Methane Outreach Program in collaboration with EPA and DEP with current emphasis on a fuel cell demonstration plant fueled by landfill gas and owned and operated by the Braintree Electric Light Department; (3) the Renewable Portfolio Standard, a component of recently enacted legislation deregulating the electric utility industry. A significant portion of the work is concerned with the development of eligibility standards for advanced technology, low-emission biomass power plants. The work is carried out with the assistance of a 25-member advisory group from industry, environmental advocacy groups, and state and federal regulatory agencies; (4) the Massachusetts Clean Cities Program which emphasizes alternative fuels, including biodiesel for transportation; (5) the BACT Study for small wood-fired boilers, a jointly-funded collaboration between Massachusetts, New Hampshire, and Vermont; and, (6) the Climate Change Action Plan, an effort led by NESCAUM. DOER plans to work closely with the Massachusetts Renewable Energy Trust Fund (MRTF), a creation of the deregulation legislation. Among its plans are programs to fund renewable energy projects, including advanced bioenergy technologies.

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New Hampshire

New Hampshire's biomass energy program has been focusing its efforts on developing new markets for the low-grade wood extracted from the state's forests. New Hampshire has recognized that producing ethanol and oriented strand board are potential uses for this wood. The Governor's Office of Energy and Community Services has been working with air regulators and industry representatives to further develop these possibilities. More recently, many of the state's sawmills have shown an interest in deploying combined heat and power equipment at their facilities to utilize waste sawdust and, as a result, to reduce overall energy costs. The biomass energy program is assisting these

companies through the state's Industries of the Future program. Additionally, the NRBP and the Northeast Hearth Products Association (NEHPA) have been active in a Clean Heat Woodstove Exchange program. New Hampshire Governor Jeanne Shaheen issued a proclamation showing her endorsement of the Woodstove Exchange program in New Hampshire. Since 1993 the joint effort in the region has permanently removed nearly 2000 older woodstoves from use and replaced them with new cleaner-burning EPA certified models. Nearly 400 tons of particulate emissions have been removed from the air in the Northeast as a result.

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New Jersey

The New Jersey Biomass Energy Program (NJBEP), administered by the Department of Environmental Protection, continues to promote and develop bioenergy through state-specific activities, as well as through projects focused on regional initiatives. Among other state activities, the NJBEP has served as a member of the DEP working group that developed Interim Portfolio Standards for Class I Renewables within the guidelines of the state's Electric Discount and Energy Competition Act. These standards will direct the advancement of renewable energy source power production, including biopower, in New Jersey's energy future. The NJBEP participated in the state's Greenhouse Gas Action Plan Working Group. This group created the added opportunity for bioenergy to help New Jersey meet its Greenhouse Gas reduction and mitigation goals. Also, as a member of NRBP's Ethanol Working Group, the NJBEP is helping to develop a regional strategy to establish the capacity to produce ethanol within the northeast region. Another successful state-specific project was the co-firing of wood and coal at a power plant. This project generated air emission, combustion efficiency, full mixing logistics, and economic data on co-firing, not only for this utility, but for other facilities in the region as well. The work on establishing in-state biomass feedstock research plots using hybrid willow and aspen will provide a base for growth and management data that will help establish large-scale bioenergy plantations in the state. Recent work gained the approval of a permit for a large lumber mill to produce electricity, heat, and process steam from their wood residues. This has created significant opportunity not only for the company itself, but also for the development of this option in other similar facilities throughout the state.

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New York

The New York State Energy Research and Development Authority (NYSERDA) is actively developing bioenergy systems that range from testing willow energy cropping systems to converting waste cellulose into high value-added chemicals. Each of these endeavors will be successful due, in part, to a valuable collaboration with the NRBP. A recent NRBP project involved converting New York City waste paper into levulinic acid at a demonstration facility in South Glens Falls. Using technology made available through a Cooperative Research and Development Agreement with the Pacific Northwest National Laboratory, levulinic acid can be converted to methyltetrahydrofuran for use as a fuel component. Additionally, the NRBP is helping NYSERDA work with New York's farmers on biomass issues. A highly successful agricultural workshop was held in July, 1999, focusing on the energy issues, business trends, and environmental drivers facing farmers. Biofuels and biomass issues were highlighted. More than 100 people attended. After the workshop, NYSERDA issued a competitive solicitation (PON 479, On-Farm Agricultural Innovation). At the same time, the NYS Farm Bureau helped NYSERDA market its PON by placing advertisements in farm publications. As a result, a record number of proposals (75) were received from New York's agricultural community. Of these,

18 were selected in February, 2000. Another agriculture workshop is planned for November, 2000. NYSERDA is an active member of NRBP and is also a major sponsor of Bioenergy 2000.

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Pennsylvania

After fifteen years of being managed by the Bureau of Forestry, the NRBP program established a new hosting relationship with the Department of Agriculture in 1999. Also in 1999, the University of Pittsburgh and the Federal Energy Technology Center completed tests of air emissions from the co-firing study at the Pittsburgh Brewing Company. The testing included air emission measurements from coal and wood/coal mixtures. The success of this test has prompted a Pittsburgh area coal distributor and wood recycler to develop a plan to offer a commercial coal/wood mixture in the area. Additionally, nearly 10,000 willow and poplar cuttings were planted on two acres of land owned by Lafayette College in Easton. The planting is part of a test program being conducted by the NRBP, the U.S. Forest Service, and the State University of New York's College of Environmental Science and Forestry. These trials provide valuable information about the adoption of specific clones to particular soils and climates. Trial results will be used to make specific recommendations for extension personnel and potential growers on which clones are best suited to a particular site. The NRBP, through its state grant program, is helping to support these site trials and is responsible for creating the partnership. Additionally, the state completed an assessment of the barriers to biofuel (biodiesel and ethanol) use in the state, and how to develop new opportunities for increased biofuel use. The project identified more than 350 federal and state fleets in the State. Ten fleets currently operate E-85 vehicles in Pennsylvania. None of these vehicles now use E-85 fuel, and only half of the fleet managers knew that they had the flex-fueled vehicles in their fleets. The results of this project point to an increased need to educate fleet managers on the benefits of E-85 and the need to work directly with procurement officials to buy and locate flex-fuel ethanol vehicles in clusters to facilitate the development of E-85 refueling stations.

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Rhode Island

The Rhode Island State Energy Office (RISEO) has focused its efforts on promoting the development of biofuels in and around the region. The RISEO, in conjunction with the NRBP, World Energy Alternatives, and Oldport Marine in Newport, RI ran a successful marine biodiesel program during the 1998 and 1999 boating season. Oldport Marine, one of the largest marinas in the Newport area, ran all of its launches on 100% biodiesel, as well as one of its most popular tour boats, "Amazing Grace." The marine biodiesel program was well covered in the media, and Oldport used over 5,000 gallons of biodiesel in each boating season. Presently, the RISEO is focusing its biodiesel efforts on heavy-duty vehicles, specifically, snow removal vehicles owned and operated by the state Department of Transportation. Rhode Island is also interested in bringing E-85 into the state, and is developing a project to facilitate the use of E-85 by fleet vehicles in the state. The RISEO is working closely with the Ocean State Clean Cities Group in this effort. The RISEO is also looking for grant funds to install an E-85 storage tank so that E-85 vehicles operated by the USPS could be relocated to Rhode Island. The Rhode Island Renewable Collaborative, the organization charged with administering Rhode Island's systems benefits charge, has approved a landfill gas project at the Cranston Landfill. A not-yet-completed study by the Department of Environmental Management (DEM) is delaying the

project. There is also a Landfill Gas Expansion Project for the Central Landfill in Johnston which is awaiting completion of another DEM study. Each fall, the RISEO holds four "Woodstove Safety and Use Workshops" at various fire stations around the state.

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Vermont

The goal of the Wood Energy Program in Vermont is not only to reduce dependence on non-renewable fossil fuel, but also to improve the health and viability of the state's forested lands and rural economy while simultaneously lowering the contribution to global climate change through reductions in greenhouse gas emissions. The Department of Forests, Parks & Recreation (FPR), the Department of Public Service (DPS), and other state and non-profit agencies continue to cooperate to assist institutional, commercial, and industrial conversions to bioenergy systems. Wood-fired systems heat two major state office complexes and four other state facilities, as well as 55 State Highway Department garages. Wood chips are now used by 23 schools as their primary heating fuel, with three new schools coming on-line in 2000. Additionally, 25 commercial and industrial wood-fired boilers are in use, most of these in the forest products industry. Four of these facilities also have co-generation systems. The "Vermont Biomass Gasification Project" continues to move forward. The gasifier, located at the McNeil Generating Station in Burlington, has recently undergone extensive modifications and completed a twenty four-hour test run. It is expected to enter an extended testing period beginning late in 2000. The City of Montpelier, along with its state government partners, is evaluating the possibility of constructing a biomass district energy system to serve buildings in the city's downtown. District energy experts from the Canadian Centre for Mineral and Energy Technology (CANMET) have agreed to assist with the project, and will be conducting a feasibility study this fall. Building on Vermont's success in installing wood-chip heating plants in public buildings and in developing biomass combined heat and power systems, the DPS is taking the lead in forming a project-based, non-profit Biomass Energy Center to serve the northeast and beyond.

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Pacific Northwest and Alaska

Alaska

Biomass energy development activities in Alaska focus on utilization of waste from the forest products manufacturers, fish processors, and rural villages. Focus in the timber-rich southeast panhandle is on ethanol production, where the state and DOE are supporting the regional native corporation Sealaska in its efforts to develop a facility to convert residues from sawmills and log sort yards into ethanol. Using around 100,000 dry tons of sawdust and hog fuel, the facility would produce five million gallons/year of ethanol, approximately the amount of oxygenate required by the gasoline consumed in Anchorage for carbon monoxide pollution measures. Other anticipated benefits from ethanol production include regional economic development and improved solid waste management. In the state's vast interior, a lower tech approach to biomass utilization is being pursued by a number of communities with nearby-wood-fired district heating. The City of McGrath is seeking financing to expand its diesel-fueled combined heat and power system and to add a chip-fired boiler to displace around 80,000 gallons of imported oil each year. Meanwhile a number of other remote villages are interested in smaller district heating systems using local sawmill residues, similar to an earlier

successful project in Dot Lake assisted by the state and DOE through the PNW&ABP. In the Aleutian Chain, responding to interest by the fish processing industry, the City of Unalaska, and potential anaerobic digestion (AD) project developers, the biomass program sponsored an assessment of fish and other biowaste in Dutch Harbor, the nation's largest fishing port. Fish plants in Dutch Harbor produce over 200,000 tons/year of waste from ground fish processing operations. Although much of this is converted into fish meal, there is potential to "base load" an AD facility using fish and food waste produced during the off-seasons, converting it into biogas for use by existing industrial boilers or diesel generators. Meanwhile, the state biomass program is working with university and state environmental staff to prepare a handbook on small-scale waste combustion. Targeting the 200 or so remote communities in the state that face major difficulties in managing municipal solid waste, the publication will include a compendium of small-scale (<10 tons/day) systems and address capital and O&M cost and opportunities for energy (heat) recovery.

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Idaho

The Idaho Energy Division (IED) and the PNW&ABP are pioneers in developing the use of biodiesel as a liquid fuel. Its most recent initiative, the "Over-the-Road Heavy Duty Truck Demonstration Project," is a three-phase project. The first phase, completed in 1997, addressed truck engine performance and emissions testing using 4 different fuel combinations. Phase 2 was a 200,000-mile over-the-road demonstration in a heavy truck using biodiesel formulated from hydrogenated soy ethyl ester. Phase 2 recently went over the 200,000-mile threshold, and the IED organized a media event that was covered locally as well as nationally. Doing its part to meet the alternative vehicle requirements of the Energy Policy Act of 1992, the state recently bought an additional 48 E-85 vehicles, bringing the total number to 111. In its "Alcohol-High Water Content Fuel and Igniter Demonstration Project," the IED is working with several partners to evaluate a new engine technology using ethanol and water (aquanol) as a fuel in internal combustion engines. A partner has developed technology using "catalytic igniters" that replace the spark plugs traditionally used in Otto-cycle engines. The project's first phase will be a preliminary verification of the technology by testing the catalytic igniter in a stationary engine. In the second phase of the project, the igniters will be installed in an IED vehicle for an on-the-road demonstration. Because the ethanol in aquanol does not have to be dried into anhydrous ethanol for use in E-10 or E-85, production costs for aquanol should be lower. Also, the water content in aquanol lowers the temperature of combustion, greatly reducing the production of NOx. The IED also funded one of the 14 contenders chosen to participate in the 1999 National Ethanol Vehicle Challenge.

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Montana

The Department of Environmental Quality (DEQ) and the PNW&ABP conducted several projects to show that the use of biodiesel, E-10, and E-85 could be part of the attempt to increase transportation efficiency and reduce vehicle pollution in and around Yellowstone National Park (YNP). In YNP, the "Snowmobile in the Park Project" demonstrated that using E-10 and bio-based (biodegradable) lube oils in snowmobiles increases energy efficiency, thereby reducing pollution and potential health problems. The YNP staff has operated the Park's fleet of 100 snowmobiles with E-10 and bio-based lube oil since 1997. The test persuaded the National Park Service (NPS) at YNP to use E-10 year-

round in all gasoline-powered vehicles. Further assistance from DEQ persuaded NPS managers to require that E-10 be available year-round in all of Yellowstone's public service stations, starting in September, 2000. NPS also included the use of E-10 and low-emission bio-based lube oils in their winter use environmental impact statement. This will require the exclusive use of bio-based fuels and lubes in YNP and Grand Teton NP, possibly as soon as November, 2002. Project findings caused West Yellowstone snowmobile and snowcoach rental agencies to voluntarily use E-10 and bio-based lube oils to reduce emissions and costs, and to increase power. Project results persuaded Outboard Motor Company to produce and supply a highly biodegradable lube oil for NPS to use in high-horsepower direct-injection marine engines on Yellowstone Lake. These engines are certified to meet EPA's emission requirements for 2006. The bio-based lube oil improves fuel economy, reduces pollution, reduces the persistence of the emissions in the environment, and reduces cancer risk from emissions by 30%-60%. Results of this project led to the development of the Society of Automotive Engineers (SAE) Clean Snowmobile Challenge (CSC) 2000 in Jackson, Wyoming. The DEQ provided funding for CSC2000, in which SAE collegiate chapters entered a competition to reduce the environmental effects of snowmobiles. The winners achieved fuel economy of 27.4 mpg (from 9.7 mpg), reduced HC emissions by 99.5% and reduced CO by 50%. DEQ's "Truck in the Park Project" demonstrated that the use of B-100 in NPS vehicles can reduce HC, PM, NOx, air toxics, and carcinogenic hazard in emissions, without attracting bears. The "Truck in the Park" project vehicle will be included in YNP's Historic Vehicle Collection after an evaluation of engine wear caused by the fuel after 200,000 miles. DEQ provided funds and assisted the NPS in its decision to use B-20 with low-sulfur diesel in its employee rideshare bus that travels over 500 miles per week from Livingston, MT to Mammoth, WY. Trucks that move 70% of the Park's trash will also use B-20. The project convinced several U. S. Forest Service managers surrounding Yellowstone NP to use B-20 and E-10 as well.

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Oregon

The Oregon Office of Energy (OOE) commissioned a study to evaluate the economic feasibility of producing ethanol from cellulose feedstock. The study included a preliminary assessment of the quantity of suitable feedstock available in the state. Economic evaluations were performed by NREL as an additional study component. OOE recently published the project's final report, *Oregon Cellulose-Ethanol Study*. As a follow-up, OOE has commissioned a report on the potential use of forest biomass. This report will discuss forest conditions in the western states and focus on two "case studies" in Oregon. Excess, unnatural accumulations of biomass might be thinned from those forests where such conditions exist and used as an energy facility feedstock. At the same time, removal of the excess would help to improve forest conditions and reduce wildfire risk. Potential uses for the forest biomass feedstock include ethanol production and the generation of electricity. The forest biomass report will be completed in early 2001.

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Washington

The Washington State University Energy Program (WSU/EP) is focused on the commericalization of biomass to ethanol fuel with a special interest in lignocellulosic materials. WSU/EP assisted in resource assessments for waste agricultural products, co-sponsored an ethanol workshop with the state of Oregon, assisted the California Energy Commission in their Biomass-to-Ethanol study,

provided technical assistance to the state of Alaska on the "Sealaska Project," assisted a technology developer with a gravity pressure hydrolysis process, and prepared a study on supply curves for cellulose to ethanol facilities in the Pacific Northwest. In addition, WSU/EP continues to work on the commercialization of the anoxic gas flotation (AGF) process that enhances the conversion of sewage sludge to methane by 50%. A joint proposal was submitted to DOE to install a microturbine at the Washington facility that is the first commercial application of the AGF process. Outreach efforts include invited speaking engagments for the U.S. Agency for International Development, the Washington Department of Ecology, the Pellet Fuels Institute, and the California Energy Commission. The general theme of the presentations were the linkages and opportunities of bioenergy and global climate change.

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Southeast

Alabama

A project using switchgrass to co-fire with coal is making good progress. Switchgrass yields were on the order of 4-5 tons/acre in 1999, with expectations of up to 7 tons/acre in 2000. One of the project participants has successfully co-fired switchgrass in concentrations of up to 10% with coal in their laboratory test facility. The testing has not found any slagging or fouling problems. However, it did reveal some problems in handling commingled switchgrass and coal. A test burn, lasting three weeks and using 1200 to 1500 tons of switchgrass, was recently conducted. Due to problems with commingled fuels, the switchgrass will be directly injected into the boiler instead of fed in a commingled fashion. The Alabama Ethanol Workshop, part of the RBEP Ethanol Workshop Series, was held in September, 1999. At the conclusion of the workshop, those in attendance agreed to form a support group to assist in promoting and developing ethanol fuels in Alabama. This group has had a follow-up meeting, which focused on ethanol production instead of market development. Additionally, there is growing interest in developing a thermochemical cellulose feedstock ethanol pilot plant. This operation could potentially use poultry litter as its primary feedstock. The disposal of poultry litter is becoming a major problem nationally and in the state. Alabama is host to the second largest poultry-producing county in the U.S. and the largest chicken processing plant in the world.

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Arkansas

Arkansas is blessed with a tremendous potential for biomass production. A 1995 study estimated the total amount of biomass produced annually in the state would fill 240,000 railroad boxcars and would be 2,500 miles long! In terms of wood volume burned per household, Arkansas ranks in the top five in the nation. To promote a more beneficial use of the state's wood residues, a project was developed in collaboration with Winrock International and the Rural Conservation and Development Councils to address the advantages of using pellet stove heating appliances. The project educated a wide segment of Arkansas' population about using pellet stoves fueled with wood waste pellets. The project increased public awareness on the environmental and economic benefits of renewable energy use, and helped to develop a commercial interest in local pellet manufacturing industries. The "North Arkansas Pellet Stove Project" involved the installation of wood pellet stoves in more than 30 counties to demonstrate how easy the stoves are to use. Although there were some initial installation problems, the stoves made a favorable impression and the public education process went well. More

than 15,000 people saw a working pellet stove as a result of this project.

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District of Columbia

Since joining SERBEP in 1995, the D.C. Energy Office (DCEO) has worked to establish bioenergy programs that are practical for the urban setting. One initiative developed a biomass energy education program for elementary students in the city's schools. Through the years, it became apparent that energy education was an important part of the energy services provided to the community. Even more important is the need to reach students at an early age to expose them to the fundamentals of energy efficiency and alternative fuels through workshops and curriculum training. The DCEO also sponsored a display detailing the history of alternative fuels at a recent meeting of the Clean Cities Program.

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Florida

Energy conservation remains an important concern to all of Florida's citizens, which has led to a renewed interest in biomass. One of the current bioenergy efforts is the "Dairy Unit Biomass Project," being conducted by the Soil and Water Science Department of the University of Florida. The site is a typical dairy farm of 1,000 cows in Hague, Florida. The objective is to demonstrate the use of a fixed-film anaerobic digester that simultaneously treats wastewater and produces energy in the form of methane-rich biogas. The "Biomass Co-Firing Project" is being conducted by the Common Purpose Institute, which instituted a strategy of fuel switching rather than building new generation capacity. Materials Recycling of Orlando uses the organic materials deliberately diverted from a landfill to produce commodities. These commodities include electric power, hydrogen gases, wood chips, insect repelling mulch, topsoil, firewood compost, and lumber. The "Biomass Energy Crop Project" is studying the feasibility of growing eucalyptus trees with a harvest cycle of four years. In addition, Leucaena trees that have an annual harvest cycle have also been planted. These crops will be used for energy fuel at the 200-acre site which is in close proximity to an existing electric utility power plant. The Suwannee River Mobile Irrigation Laboratories (MIL) concerns themselves with the reduction of nitrate infiltration into the Suwannee River and aquifers. The MIL recommends techniques to reduce contamination and the damages caused by animal wastes, septic tanks, and organic fertilizer residues. The MIL establishes a level of water savings and then determines project effectiveness on improvements in the irrigation water management schedule.

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Georgia

Partially funded by SERBEP, the Georgia Forestry Commission (GFC) works to promote wood waste utilization across the state. Bioenergy is encouraged as a use for the urban wood waste resulting from development, and also for the by-products from wood processing plants. The Advanced Wood Products Laboratory at Georgia Tech has been assisted by the GFC and SERBEP. The laboratory was established in an effort to better utilize the products from Georgia forests and to train skilled workers for the industry. Companies are assisted in establishing and operating firewood manufacturing operations for both primary and secondary sources of heat. The University of Georgia's College of Agricultural and Biological Engineering has worked to assess the amounts of wood residues that are produced in the counties surrounding the campus in Athens. GFC program personnel provided interpretation of the Forest Inventory and Analysis report and assisted in the collection and dissemination of the information contained in the bi-annual *Timber Product Output* report. The data for the *2000 Wood Using Industry Marketing Directory* which lists wood energy users, their addresses, and types of equipment on site are being collected. These publications are widely distributed by the GFC. Jointly, these measures address the education, economic, and production issues of bioenergy use in Georgia.

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Kentucky

A recent SERBEP grant helped the Paducah Sewer Agency use methane produced anaerobically on-site to power a motor-driven blower in another part of the plant. A project to recover methane from the state's largest landfill, Outer Loop in Louisville, for use as fuel in a nearby industrial facility was completed successfully. The Commonwealth's motor pool fleet of E-85 flexible-fueled vehicles has now expanded to more than 700 vehicles, and additional refueling facilities are being planned. The Kentucky Wood Waste Alliance, formed in 1998, has worked to facilitate the diversion of wood residues to productive uses. In four recent cases before the public utility commission, the Kentucky Division of Energy has recommended that utility companies include sawdust cofiring at low percentages at existing coal power plants in their future resource plans. In its work on a task force studying electric industry restructuring, the division is supporting rules to encourage environmentally beneficial distributed generation, which would benefit biomass and other renewable energy technologies.

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Louisiana

Louisiana is a state blessed with numerous natural resources and an environment conducive to growing and producing biomass. Because of the extended growing season, timber and agricultural crops are grown throughout the year producing tremendous quantities of biomass. Louisiana is a major producer of fossil fuels, providing relatively inexpensive and abundant natural gas for residential and industrial use. Natural gas is the fuel of choice for most industries. The Louisiana Department of Agriculture and Forestry (LDAF) recognizes the potential for bioenergy development and the challenges presented by industry's preference for natural gas. The LDAF has maintained a long standing, cooperative relationship with SERBEP in an effort to develop a local understanding of the potential for using biomass derived fuels. SERBEP-funded projects have included a directory of wood chip producers; an assessment of biomass fuels available in the state; the creation of a GIS-based database of biomass fuels, producers and users; an analysis of fuel content and applicability of

various baled agricultural residues; a publication depicting the biomass energy situation in the state and opportunities for use; and, the formulation, analysis, and design of an environmentally friendly fire log using natural binders. Because of the tremendous potential for biomass production and bioenergy use, the general lack of understanding for what bioenergy actually is, and the need to create additional markets for agriforestry residues, the LDAF will continue to seek opportunities for developing bioenergy opportunities with SERBEP and the RBEP network.

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Mississippi

The Mississippi Biomass Council (MBC) is a nonprofit corporation of business, university, and government leaders organized to provide statewide coordination of research, development, technology transfer, and commercialization of biomass, bioenergy, and bio-based products. The Council partnered with Jackson State University and the Energy Division of the Mississippi Department of Economic and Community Development (MCECD) to host an ethanol and biopower conference in 1999. National and local speakers presented an array of topics on ethanol and biopower. The workshop concluded with small discussion groups identifying issues, concerns, and barriers to widespread production of ethanol and the use of biopower in Mississippi. The consensus of these discussions was that MDECD would work with the MBC to develop an assessment to determine the potential to produce ethanol fuel and to develop a strategic biomass plan. Several strategic planning meetings grew from the conference in addition to a database that quantifies biomass feedstocks statewide. The website for this database will be available in January, 2001.

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Missouri

The Comprehensive Energy Policy Act of 1992 (EPA) requires state fleet authorities, as well as certain federal fleets and the fleets of alternative fuel providers such as utilities, to purchase vehicles capable of running on alternative fuels on a phased-in basis. Municipal fleets such as those operated by the City of St. Louis Municipality are impacted by this regulation. In addition to purchasing alternative fueled vehicles, due to legislation passed by Congress in 1999, EPA credits can now be satisfied through alternative fuel purchases. This can be highly desirable to fleets because now biodiesel and biodiesel blends can be used in exisitng diesel powered vehicles. Biodiesel can be used by existing diesel engines without engine modifications or purchasing new vehicles. With funds from the Department of Natural Resources, the Energy Center and SERBEP, the City of St. Louis Equipment Services Division (ESD) performed a limited economic analysis to examine three alternative fuel technologies that are available to the City of St. Louis: compressed natural gas, E-85, and biodiesel. In addition to the environmental advantages of using biodiesel, improved energy security, and the potential economic advantages of producing and using biodiesel in Missouri, the study also indicated the following advantages: 1) biodiesel is an excellent alternative fuel that can help fleet operators comply with legislation such as EPA; 2) vehicle operators in the St. Louis fleet were extremely pleased with the testing of B-20 blends that occurred during 1999; 3) the production and use of 450 gallons of biodiesel in the fleet results in one credit, similar to the purchase of one alternative fueled vehicle which also results in one credit; and 4) based on study results, B-20 is the least cost method for the City of St. Louis to comply with EPA.

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North Carolina

Because of the large concentration of animal production in the state, several projects have been developed to address the use of manure and food processing residues. A new project is investigating an innovative swine waste management system to use recovered nutrients, waste heat, and CO2 to produce tomatoes in a greenhouse at Barham Farm. The farm's current waste management system includes a covered primary lagoon for waste treatment that produces methane-rich biogas, and a secondary lagoon for long-term storage. The biogas is used to operate an electrical generator, which also produces waste heat and CO2. The nutrient-rich effluent recovered from the secondary storage lagoon will be used to irrigate a greenhouse tomato crop, instead of being spread on a nearby hayfield. The greenhouse will use electricity and waste heat that is not presently used by the hog operation, as well as use the CO2 to increase crop yield. The project will evaluate this innovative system from several different perspectives: plant growth and development; waste heat and CO2 utilization; nutrient recovery from the waste stream; odor monitoring; human pathogen monitoring and control; and economic merit. Two other projects are evaluating the conversion of swine manure and solid food wastes into fuel grade ethanol. The objective of the swine manure project is to determine the technical and economic merit of using gasification technologies to convert swine waste to fuel grade ethanol while recycling the nutrients they contain. The second project uses a mixture of various food processing wastes (bakery products and potato wastes) that are co-fermented with cheese whey in the presence of Temamyl, High T, and Alcoholase II enzymes. The average ethanol yield is 33% greater than might normally be expected. About one-third of this increase was due to the presence of a 5% lactose in the cheese whey and two-thirds due to the combined effect of milk protein and minerals in the cheese whey.

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South Carolina

The South Carolina Energy Office (SCEO) supports and promotes the use of indigenous energy use in South Carolina. The SCEO has been active in promoting the recovery of biogas from municipal and industrial wastewaters and landfill gas. A landfill project under development will pipe landfill gas about ¾ mile to power a county detention center. This project could result in the county saving over $100,000 annually. The SCEO has also undertaken a project to encourage the use of on-farm biogas production. This project will determine the most cost-effective method for implementing on-farm biogas systems. The project reviewed the costs and performance characteristics of three types of AD systems for local production techniques and weather factors. Animal manure should be regarded as a valuable resource for both plant nutrients and as a fuel source to help reduce the costs associated with modern livestock production facilities. The SCEO, in conjunction with SERBEP and other partners, also conducted a study to determine if soybean-based biodiesel could be an alternative transportation fuel. In terms of acres planted and commodity value, soybeans are currently the number one crop in the state. The project has been well received by the target audience. Despite the relatively high cost of the biodiesel mixture, it has proven attractive because it is clean-burning and usable without any engine modification.

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Tennessee

The Energy Division provides technical assistance to companies interested in using a variety of bioenergy resources, primarily wood residues. One example, Tennessee's Bioten Corporation, is continuing business discussions with private companies and government agencies to develop their proprietary bioenergy project at Red Boiling Springs. The cogeneration-capable unit produces 6.3-mW by burning 10 tons/hour of finely ground sawdust wood waste from area lumber businesses. The combustion gases drive an aero-derived jet turbine that powers the generation unit. The company has an agreement with the Tennessee Valley Authority for power peaking sales. This evolving process and physical plant development has been in operation since 1981 and provides a valuable alternative to landfilling or direct burning of the area's waste sawdust. The system has completed operational evaluations with a variety of other alternative biomass fuels and offers the residual potash for sale as fertilizer. Maryville College, operating the oldest wood power system in Tennessee recently completed an evaluation of the feasibility of using Bioten system on campus.

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Virginia

In 1999, SERBEP funds were used to update a database of biomass-using facilities in Virginia. The Southeast Biomass Facility Information System (SE-BFIS) database contains data on facilities in the southeastern United States that consume or produce energy from biomass. Attempts were made to verify and update contact information and biomass use and production data for all Virginia facilities listed in the existing database. Additional facilities were identified using lists provided by the Virginia Department of Environmental Quality's Office of Air Data Analysis, the Brooks Forest Products Center of Virginia Polytechnic Institute and State University (Virginia Tech), and the Virginia Department of Forestry. These additional facilities were surveyed, and, where appropriate, were added to the database. The effort resulted in increasing the number of Virginia facilities in the SE-BFIS database from 49 to 158. Contact data have also been verified for all of the facilities. An innovative agribusiness venture will not only transform poultry litter into an organic based fertilizer, but will also use litter as fuel to power the facility. The "Harmony Shenandoah Valley Project" will create 15-25 new jobs, and will use up to 50,000 tons of excess poultry litter to produce a variety of value-added fertilizers for home and commercial markets. The business will be located in Harrisonburg, home of one of Virginia's leading poultry companies and a key partner in the new business. The environmental benefits of the project are significant, both for farmers and for the public. By transforming poultry litter into an organic-based fertilizer, the enterprise provides Virginia's poultry farmers with another option for utilizing excess litter with the added benefit of protecting Virginia's water quality.

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Virgin Islands

SERBEP has assisted the Virgin Islands Public Works Department (VIPWD) in drafting a Request-for-Qualifications and Request-for-Proposals for a contractor who will be responsible for all aspects related to the ownership, financing, design, construction, startup, performance testing, operation, maintenance, marketing, management, and other activities to process or handle all solid waste generated in the territory. The proposed system may include energy recovery and potable water co-products. Additionally, the VIPWD has completed a landfill gas assessment study. The St. Thomas Bovoni landfill opened in 1980 and currently covers 34-acres with 1.2 million tons of waste in place at depths up to 90-feet. The St. Croix Anguilla Landfill opened in the mid-1960s and currently covers 33-acres with 1.9 million tons of waste in place at depths up to 81 feet. The study estimates that the St. Thomas Bovoni landfill is currently producing 460 million cubic feet per year of landfill gas and the St. Croix Anguilla landfill is producing 520 million cubic feet per year of landfill gas. These facilities would have a combined capacity of more than 3.2-mW.

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West Virginia

The West Virginia Development Office (WVDO) has used SERBEP funding to identify a wide range of opportunities for the wood products industry to create new biomass-related, value-added markets and to improve the efficiency of biomass production. These activities are coordinated through the Industries of the Future-West Virginia (IOF-WV) program, which targets industry needs as identified in state industry visionary sessions. In 1999, SERBEP co-sponsored a conference on co-firing activities in West Virginia. Approximately 60 wood, utility and government sector representatives attended the meeting. Other activities of the IOF-WV wood products sector include technical assistance to wood products companies to identify process improvement opportunities, maintenance of a database of available wood residues, and thin-kerf sawblade research. A poplar/aspen plantation demonstration program on surface mine reclamation sites is being developed. This program will provide a sustainable production of these valuable species and establish a new use for these lands. A second biomass focus area of the WVDO is the utilization of poultry litter as a value-added process. In 2000, SERBEP awarded West Virginia University funding for the purchase of testing equipment for a supercritical water reactor system which uses poulty litter as the raw material for production of a diesel-like fuel. This technology could potentially provide an on-farm use for litter and become a new profit center for the poultry farm operator. The WVDO is also working with the West Virginia Division of Natural Resources and U.S. Department of Agriculture on a demonstration of poultry litter as a substitute for commercial fertilizers on abandoned mine sites.

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Western

Unlike the other four RBEP regions, the Western RBEP (WRBEP) does not have a state grant program *per se*. Rather, the region conducts an annual solicitation from which projects are chosen with the advice and consent of its state contacts. Most of the completed reports for this region are now or will soon be posted at http://www.westbioenergy.org.

Arizona

A project, "Market Development Program for Refuse to Alcohol Plants in Arizona", was recently completed. Its purpose was to assess and develop markets for refuse to alcohol plants in the state. Tasks included evaluating the market for process products, the availability and suitability of cellulosic municipal solid waste, potential plant locations, plant economics, plant improvements, and public education activities. Another project involved conducting two half-day workshops for private and government fleet operators and fuel providers on E-85 and alternative fueled vehicles.

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California

The California Biomass Benefits Assessment Project had the objective of estimating the overall dollar value of the benefits provided by the state's biopower industry. The project was a collaborative effort with the California Energy Commission (CEC), other state agencies, and the bioenergy industry. The study found that the overall estimation process is complex, and that the resulting estimates are highly uncertain. Many of the benefits are difficult to quantify such as environmental and health issues, and reduced particulate, NO_x, and greenhouse gas emissions. Other significant benefits result from increased landfill life. For the more than 800-mW of biomass-fired capacity that was on-line in the early 1990s, the total benefits value was estimated to be about $500 million annually. About 75% of these benefits resulted from wages paid to facility workers and from tax base impacts such as property taxes. A rice straw feedstock supply study was conducted in Colusa County by the Rice Straw Feedstock Joint Venture, which is composed of a number of interested companies. This study focuses on Colusa County, which is the largest rice-producing county in California, and examines existing rice and straw resources, seasonal effects, straw collection equipment, transportation equipment and issues, end uses of rice straw and how these factors can be integrated. Under California law, by 2001, open burning of rice straw, must be reduced to 25% of historical levels. It is estimated that annually more than 1.5 million tons of rice straw are produced in the state and this material has been historically disposed of using open field burning. The phase down in open burning threatens growers by eliminating what has been their traditional disposal mechanism, and presents an opportunity to utilize the rice straw in new and innovative ways. The utilization of this biomass resource has, however, been limited by the lack of effective and economical collection and storage methods capable of delivering the rice straw feedstock in a form and quality suitable for an end user. This study reported that the aggregation of overall straw collection costs is difficult and is the source of some discrepancies in cost data. Collection is the most expensive option for rice straw management. Open burning costs $3-$4/ton, incorporation costs $20-$35/ton, and collection for use costs $28-$43/ton. All of these numbers have high levels of uncertainty, and along with the uncertainty of markets for rice straw, they define the challenge to an emerging rice straw utilization industry. California Polytechnic State University in San Luis Obispo was also recently awarded a WRBEP grant to add a microturbine and monitor performance for a lagoon methane recovery system at the University's 350-cow dairy. This project is being co-funded by the CEC through the Public Interest Energy Research Program. The biogas will fuel a microturbine electric generator designed for low-pressure medium Btu gas. The project is expected to produce more than $15,000 worth of electricity every year. The project will demonstrate the feasibility of converting flushed dairy manure wastes into biogas using existing manure storage lagoons supplemented by a special flexible cover. This project will study and document the operating parameters of the lagoon including liquid effluent, biogas production, electrical production, air emissions from microturbine, and the maintenance requirements of the equipment used in the dairy lagoon system.

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Colorado

A project, "Real-Time Remote Sensing of Snowmobile Emissions at Yellowstone National Park: An Oxygenated Fuel Study," was completed by the University of Denver to measure the impact of clean biofuels and bio-based lubricants used in snowmobiles. The project measured the emissions of biofuels and bio-based lubricants compared to petroleum products by adapting an on-road sensing device (RSD) for use with snowmobiles. A workshop on cellulosic feedstock ethanol production was held in 1999 in Golden. The workshop was highly successful, with more than 40 people attending. A principal focus was on rural economic development and the creation of value-added materials through ethanol production. Programs in other states and existing Colorado incentives were also discussed. A feasibility study on building a public access multi-fuel refueling station, prepared by the City and County of Denver Department of Environmental Health, was also completed. An analysis of biogas to energy options for Colorado swine farms was completed in conjunction with the Office of Energy Conservation and Management. The project included assessing the impact of new regulations, summarizing current AD technologies, and an economic evaluation of available conversion technologies. In conjunction with the USDA and the EPA's AgStar Program, a workshop was held in May 2000 in Lamar. The workshop also featured a tour of the innovative complete mix digester and electric generation system at Colorado Pork, LLC. WRBEP is funding a project that monitors the performance at Colorado Pork using a standard protocol. Monitoring results will be available in 2001.

Kansas

There are two recently completed projects that have the potential to increase the use of bioenergy in Kansas. Additionally, there are two other issues that are also being investigated. In the area of biodiesel, expert testimony to the state House Agricultural and Environment Committees and the Senate Agricultural Committee was presented on tallow-based biodiesel production and use within the state. A detailed overview of the technical and environmental attributes of biodiesel, as well as an outline of the tallow resource base and potential markets for tallow-based biodiesel within Kansas was provided. Also, testimony was presented at a later hearing to the state House Environment Committee on implementing low-blend levels of biodiesel by state fleets. Another Kansas biomass project is concerned with planting switchgrass on conventional cropland in Northeast Kansas to reduce sediment and nutrient loadings in the Perry reservoir. The switchgrass will be used for bioenergy production in the region. The focus of this effort is to use buffer and field strip funds provided by the state Conservation Commission, as well as funds from the USDA's Conservation Reserve Program (CRP), to enhance the return per acre if a portion of cropland is removed from production and put it into switchgrass. As one method to increase bioenergy production and use, Kansas is also seeking approval for financial incentives provided by state and federal agencies to plant and harvest bioenergy crops for alternative energy purposes on CRP acreage. This offers the potential for monetizing their environmental benefits as a means to "buy-down" the cost of energy. The project report is scheduled to be available in early 2001.

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Nebraska

A project "Fuelwood Energy Plant Visitors Center" was completed by the National Arbor Day Foundation in Nebraska City. The Foundation developed their existing fuelwood energy plant into an interpretive, educational visitors center for guided and self-guided tours. The fuelwood energy plant uses clean-burning woodchips to provide all of the energy for heating and cooling the foundation's Lied Conference Center and Hotel. A project is nearly completed to evaluate the feasibility of using the biogas from an anaerobic digester in a direct fuel cell system to provide power and process heat for ethanol production at the High Plains Corporation's facility in York. A second phase of the project

will monitor biogas production, and evaluate, select, install and monitor the performance of a biogas conditioning system for the facility. The Nebraska Ethanol Board, in cooperation with the Clean Fuels Development Coalition, updated and distributed a publication *1999 Fuel Ethanol Fact Book*. This is a fact book documenting and promoting the benefits of ethanol as a transportation fuel. A student and faculty team from the University of Nebraska entered a car in the 1999 Ethanol Vehicle Challenge. The goal was to complete specific research tasks in order to determine the necessary components needed to convert a 1997 Chevrolet Malibu, which was designed to run on conventional unleaded gas, to run on E-85. Students worked to optimize the car's performance in the following categories: acceleration and handling, cold start capabilities, emissions during starting/warm-up/long term run, fuel economy, and overall drivability using E-85. A project conducted by the Nebraska Soybean Board used a low blend level of 0.25% biodiesel in Nebraska Department of Roads heavy trucks and equipment for one year. The project showed that biodiesel can be used as a low blend additive, and that as a result, fuel economy can be increased and engine emissions simultaneously decreased by approximately 5%. The state Legislature mandated the creation of a Nebraska Biopower Steering Committee. The WRBEP state policy committee representative is working with various organizations to evaluate the potential to implement various biopower technologies in the state.

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Nevada

During the past two years, the Nevada State Energy Office's (NSEO) bioenergy development efforts have focused on green power and biodiesel production. The development of cost-effective markets for biopower in Nevada and the WRBEP region has been through green power pricing and green power marketing initiatives. The NSEO's efforts to date have been successful in developing the Tahoe Green Power Program (TGPP). See the referenced web site below for a description of the program and its partners. A continuing phase of this project is underway to promote and develop the use of green power in the Lake Tahoe basin. Building on the success of the TGPP, the NSEO has recently been working to promote a similar program using pinyon pine and juniper (P-J) residues. These residues will be produced through a massive ecosystem restoration and fuel loading reduction project developed by the U.S. Bureau of Land Management (BLM), called the Eastern Nevada Restoration Project. This project would impact approximately six million acres of lands containing P-J—approximately one-third of the entire Great Basin! Biopower utilization of the P-J resource would involve short-distance transport of the biomass feedstock to one or more small (0.5-5.0 mW), portable biopower plants. Nevada's investor-owned utility or other sellers could purchase the power in order to meet the state's domestic renewable energy portfolio standard, which becomes effective January 1, 2001. The NSEO is also working to assist a contractor on a WRBEP funded project to evaluate the available resource of trap grease and used cooking oils in Nevada and California and to develop interest in using biodiesel in government vehicle fleets. The NSEO has enlisted the assistance of other key state agencies to obtain support for the designation of B-100 as an alternative vehicle fuel under the state's alternative fuel vehicle acquisition mandate.

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New Mexico

A project is nearly completed to evaluate the potential for development of a biomass power plant co-fired with natural gas in Northeastern New Mexico. The area consists of about 3.8 million acres, and is located some 120 miles northeast of Albuquerque. The small mountain communities of Angel Fire and Cimarron are surrounded by over 1.5 million acres of state, federal, and private forestlands that

present a substantial and ongoing threat from catastrophic fire. Past management practices of forest fire suppression have resulted in an increase in standing fuel and a decline in overall forest and watershed health. This is characterized by an increase in standing fuel supplies, an increase in the amount of diseased timber, and an increase in water loss from this affected region. There is a critical and immediate need to improve forest health and decrease the fire danger by sustained thinning of four-inch or less diameter timber. A biomass power plant co-fired with natural gas would provide the incentives needed to sustain a market for harvested fuel wood, and to impact a large number of affected forested acres. The results of this study indicate that biomass from the region in the form of forest thinnings, sawmill residues, urban woodwaste, and sewage sludges could support the operation of a 13-15 mW power plant. The power could be sold either to the local grid, or nationally as green power. The local demand for power varies seasonally and is about 15- mW, but large customers within the region could use as much as 80-120 mW. The natural gas required to cofire the plant, about 25% of the fuel required, could be supplied from local gas fields. Co-firing biomass with natural gas results in lower air emissions, greater fuel flexibility, and better overall plant performance, while providing all the attributes of a renewable power source. The development of the power plant in the region could lower electric utility rates, increase employment opportunities, and immediately decrease the risk of catastrophic fire.

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North Dakota

A project, "Feasibility of Producing Ethanol from Biomass in Eastern North Dakota," is being coordinated by University of North Dakota's Energy and Environmental Research Center. The project includes an evaluation of the feasibility of producing ethanol from native aspen, short rotational woody crops, and switchgrass. The project will establish the viability of using native grasses and short rotational woody crop (SRWC) plantations in eastern North Dakota and parts of Minnesota; and evaluate the production, harvesting, and transportation costs of native grasses and SRWC plantations; evaluate the use of food manufacturing wastes, and technology options. Another project goal is to establish the viability of aspen use and management. This includes production, harvesting, transportation costs, and the impact on the land base. The study will be available in early 2001.

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Oklahoma

Oklahoma State University is completing a project on the design and testing of a system to convert biomass materials into ethanol. The proposed system would use a combination of gasification to produce syngas, and subsequent microbial catalyzation and fermentation steps to convert the syngas into ethanol. The study will also include a feedstock analysis, which includes an evaluation of the commercial production, harvest, transport and storage of biomass materials. The study is scheduled to be completed in mid-September of 2000.

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South Dakota

A workshop on producing ethanol from cellulosic feedstocks was held in Rapid City during 1999. Promotional signs and flyers were made and distributed at Ethanol Day at the state fair in Huron, which coincided with the Grand Opening of the Huron Ethanol Plant. Mailings were sent to people on mailing lists provided by South Dakota and Wyoming officials. All ethanol producers received a letter explaining the concept of the workshops and inviting them to make suggestions. The workshop was successful and focussed on the needs of South Dakota and the Black Hills region, which includes Wyoming. The Black Hills group is continuing their efforts to promote the use of cellulosic materials to produce ethanol. They are working to provide the NREL with more accurate information on feedstock availability for use in revising a preliminary feasibility study. If the revised study is positive, a more in-depth study will be considered. The South Dakota Corn Utilization Council, in cooperation with South Dakota State University, is working on a project to modify an aircraft airframe and engine and to do testing leading to FAA certification of AGE-85 (an ethanol based aviation fuel blend). The project activities include acquiring a Grumman Ag Cat airframe and R-1340 engine, modifying them to operate on AGE-85 fuel, setting up a testing schedule with the FAA, carrying out tests, and preparing reports for the FAA. The project is on schedule. The aircraft has been purchased and modifications are underway as are negotiations with the FAA for approval of a testing program. A project is underway by Dakota Ag Energy of Sioux Falls to design and analyze an integrated biorefinery. The system will feature continuous integration of ethanol production without conventional stillage drying equipment, use of the wet distillers' grains and solubles as a direct cattle feed ration, a specially designed cattle feedlot with slatted floors, and anaerobic digestion system to produce biogas for use as the ethanol plant's boiler fuel and the recovery of fertilizers from the manure. Dakota Ag Energy will also provide a pro-forma economic analysis of all of the integrated systems. The analysis will utilize an operating South Dakota farm as a basis for the analysis.

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Texas

The Texas Renewable Energy Industries Association (TREIA), with funding assistance from WRBEP, designed, planned, and conducted three one-day seminars targeted on four bioenergy areas with promise for near-term project development. The seminars, all held during 1999, were Texas Clean Transportation, Renewable Fuels Solution, Building and Industry and Infrastructure, Integrating Environmental and Energy Technologies for Large-Scale Swine Operations, and Landfill Gas Opportunities for Municipalities. All were well attended and well received by the participants. Two Texas higher education institutions were supported in competing in the 2000 Ethanol Vehicle Challenge. The faculty and students at the University of Texas at Austin, Department of Mechanical Engineering focused their efforts on developing and improving an on-board fuel distillation system to improve the startability of the vehicle. The students at the University of Texas at El Paso, Mechanical and Industrial Engineering Department focused their strategies on an on-board fuel distillation system, an optimized air injection system that rapidly heats the catalysts, engine rebuilding and optimization, a high energy multiple spark ignition system, increased mass flow rate fuel injectors, and a centrifugal supercharger with a clutch. Both teams won awards at the competition. A project is being conducted by the Texas Engineering Experiment Station, in College Station. The purpose of the project is to evaluate selected aspects of co-firing manure/coal blends in boiler burners. The project researchers are investigating the effects of moisture and particle size of manure on combustion and combustion products. The project will also correlate the results (combustion efficiency, NOx and SOx emission, and fertilizer value of ash) with the manure characteristics and conduct a detailed analysis on the economic potential for feedlot operators. The final report on the project is expected to be available in 2001. A project was recently completed by West Texas A&M at Canyon. This project evaluated the feasibility of using landfill-type anaerobic bioreactor cells for

producing biogas using low-moisture beef cattle manure. The first project phase was a series of laboratory scale experiments. The results of Phase I were then applied to two experimental bioreactor cells, each approximately 3,200 cubic feet in volume. The final report is currently being peer reviewed. A final Texas project that has been supported for some time by the DOE, the EPA, and the WRBEP is the Cratech biomass gasification system. The current phase is the market introduction of a small-scale advanced biomass gasifier. Cratech expects to be demonstrating the gasifier on the business's biomass feedstock in late 2000 or early 2001. A workshop on producing ethanol from cellulosic feedstocks is scheduled for September, 2000 in Austin. A local steering committee will insure that the workshop reflects community needs and incorporates local speakers into the agenda.

Utah

The Utah Office of Energy Services (UOES) is offering matching grants for projects promoting biomass development in their state. Partnerships with the University of Utah, Utah State University, Brigham Young University, and multiple industries have been undertaken. There are many programs at these institutions addressing problems and possible grant worthy solutions in the bioenergy area. Utah has a number of interesting bioenergy projects that are not receiving WRBEP funding. These include ultra-high efficiency tesla model turbines running on methane, and projects researching innovative ways of dealing with fish farming and hog farm manure. Research on the production of gasoline from the lignin is being conducted with OFD support through the NREL.

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Wyoming

Wyoming is scheduled to host the Clean Snowmobile Challenge in 2001. The contest will be held in both Yellowstone National Park and Grand Teton National Park in Jackson Hole, Wyoming. The project will challenge students from a number of colleges and universities to change the design of existing snowmobiles to improve noise and emissions while maintaining performance. Funding to aid in the competition is provided directly by the OFD.

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